

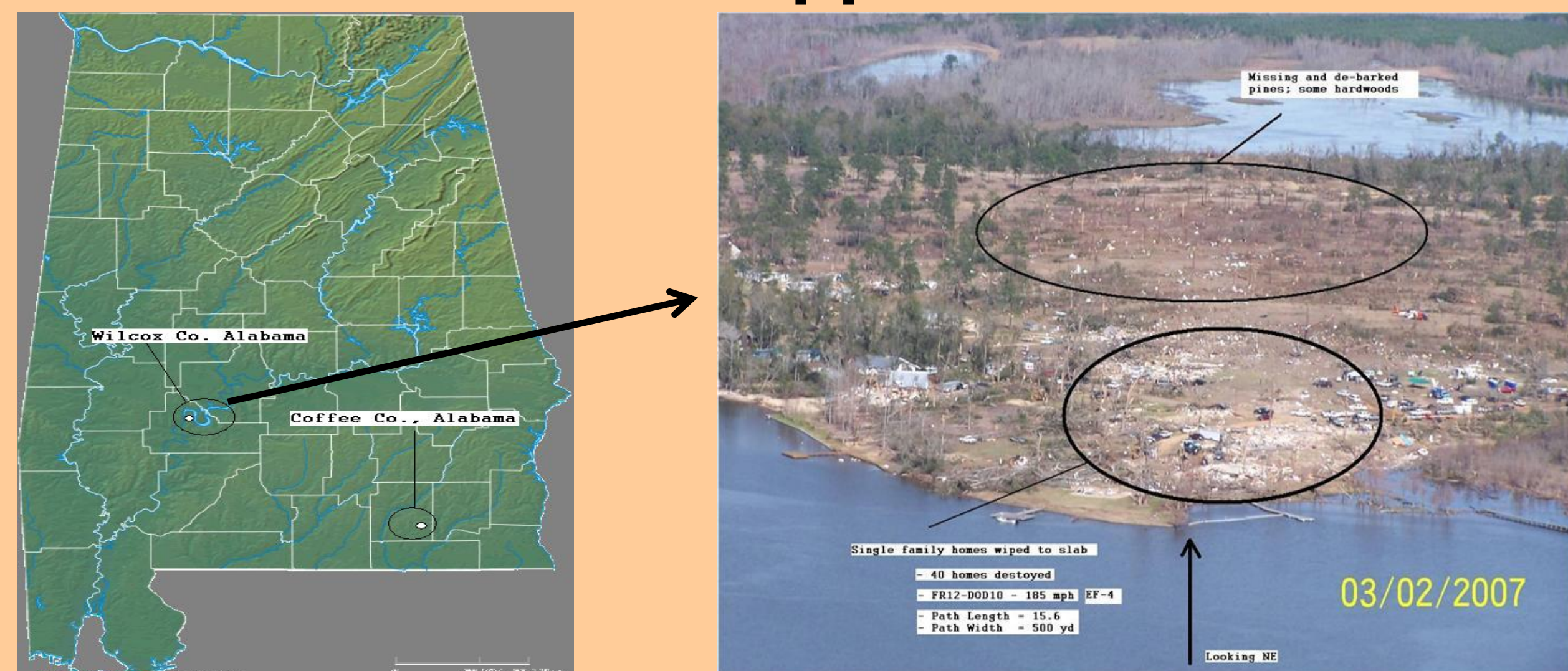
# A Multi-Scale Examination of the 1 March 2007 Millers Ferry, Alabama

## EF-4 Tornado-Producing Mesocyclone

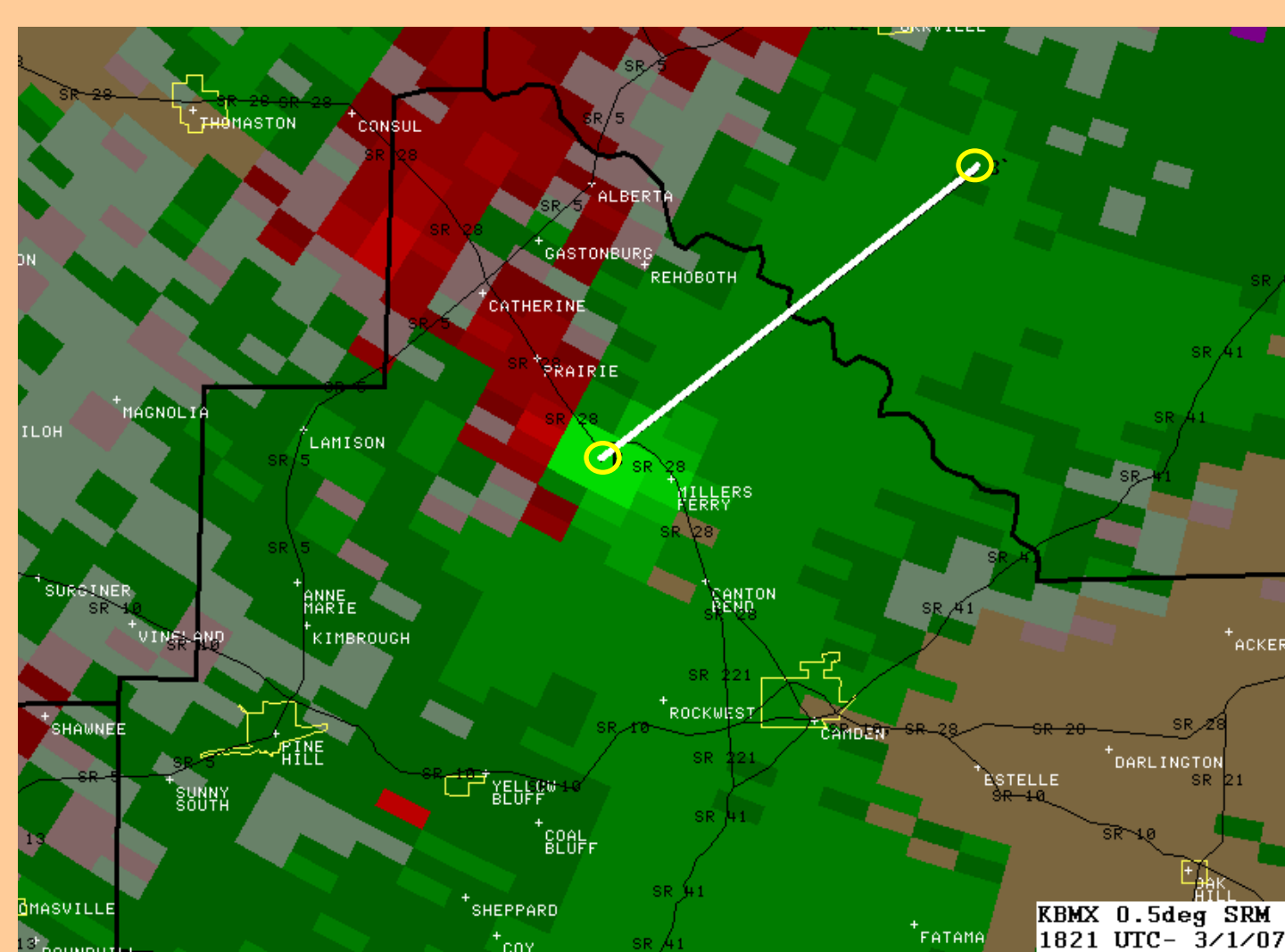
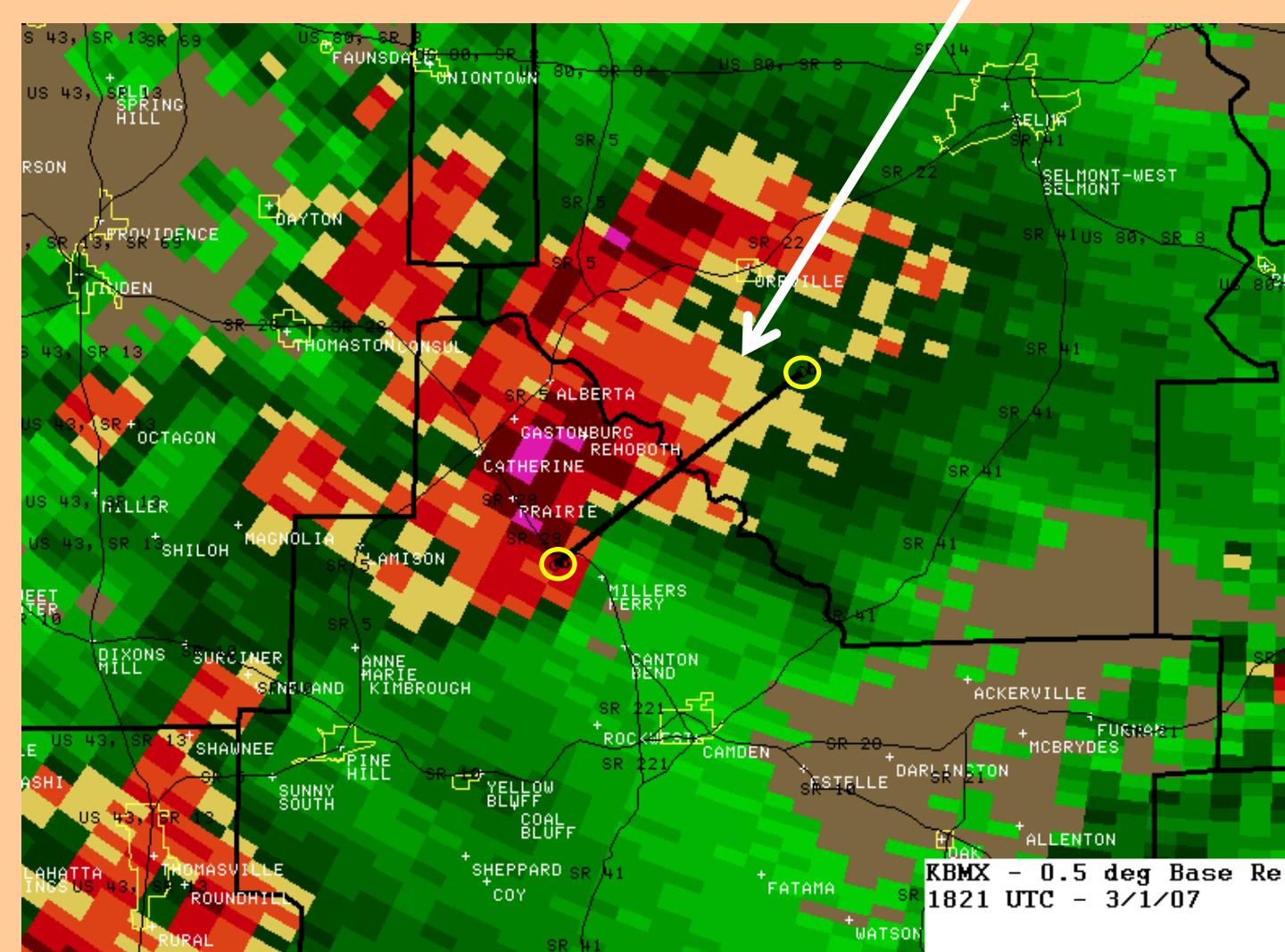
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### What Happened?



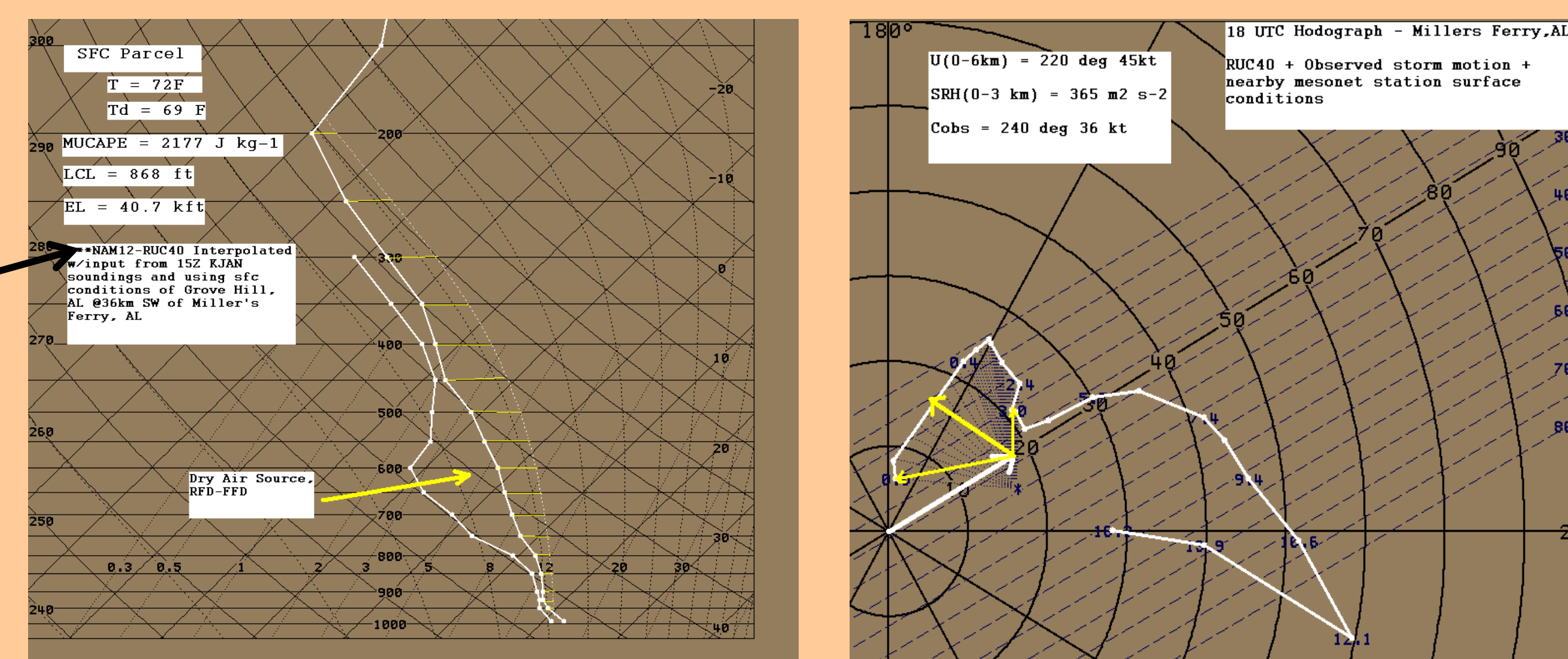
As part of the notable 1 March 2007 US Deep South tornado outbreak, a **long-lived EF-4 tornado-producing** mesocyclone developed from two merging updrafts over southeastern Mississippi at 1639 UTC and later moved eastward across much of southern Alabama during the ensuing hours. In a **pre-storm environment** characterized by 0-3 km storm-relative helicity ( $365 \text{ m}^2 \text{ s}^{-2}$ ) and surface-based convective available potential energy ( $2177 \text{ J kg}^{-1}$ ) values respectively, the southern-most updraft became dominant and was characterized by two distinctive impulses. At 1719 UTC, the first was strong but did not produce a tornado. The second developed at 1805 UTC and produced an EF-4 tornado at 1827 UTC that was approximately **25 km in path length over portions of Wilcox and Dallas counties** of Alabama and 460 m in diameter (at its widest point) near Millers Ferry, Alabama. The tornado claimed one life.



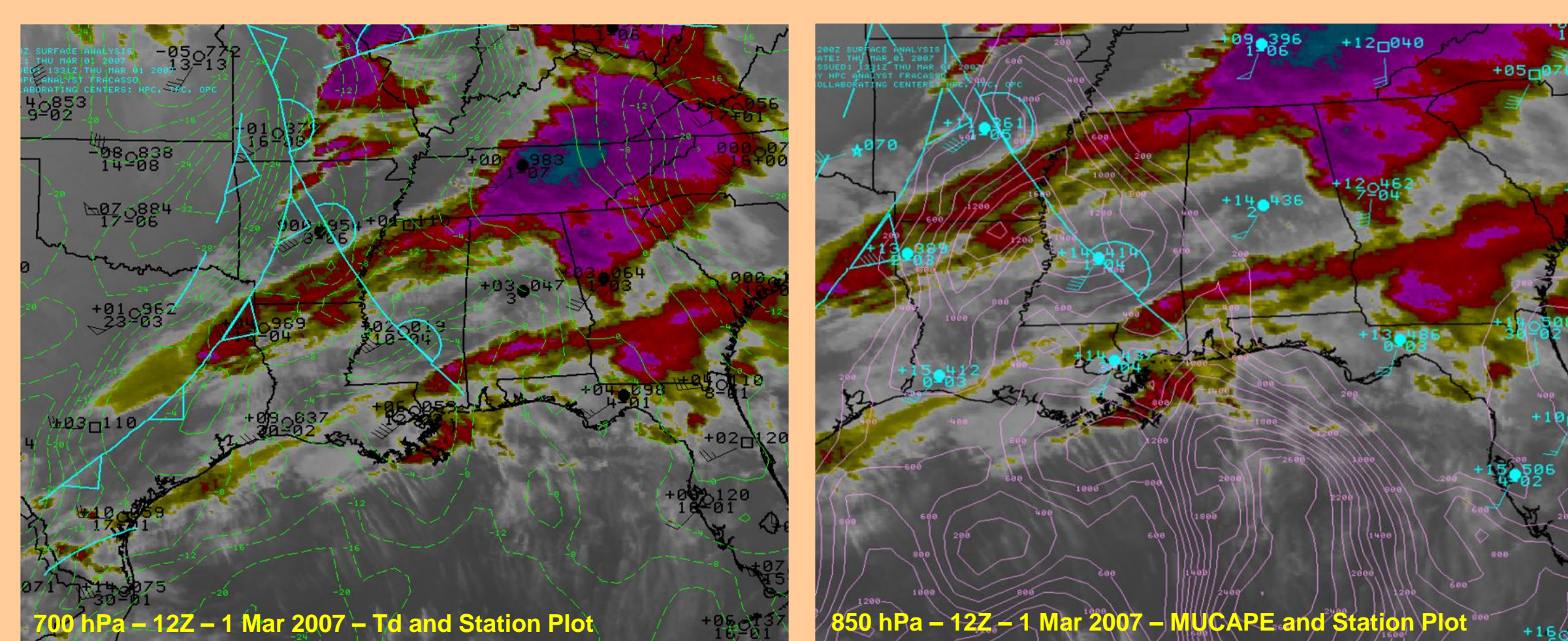
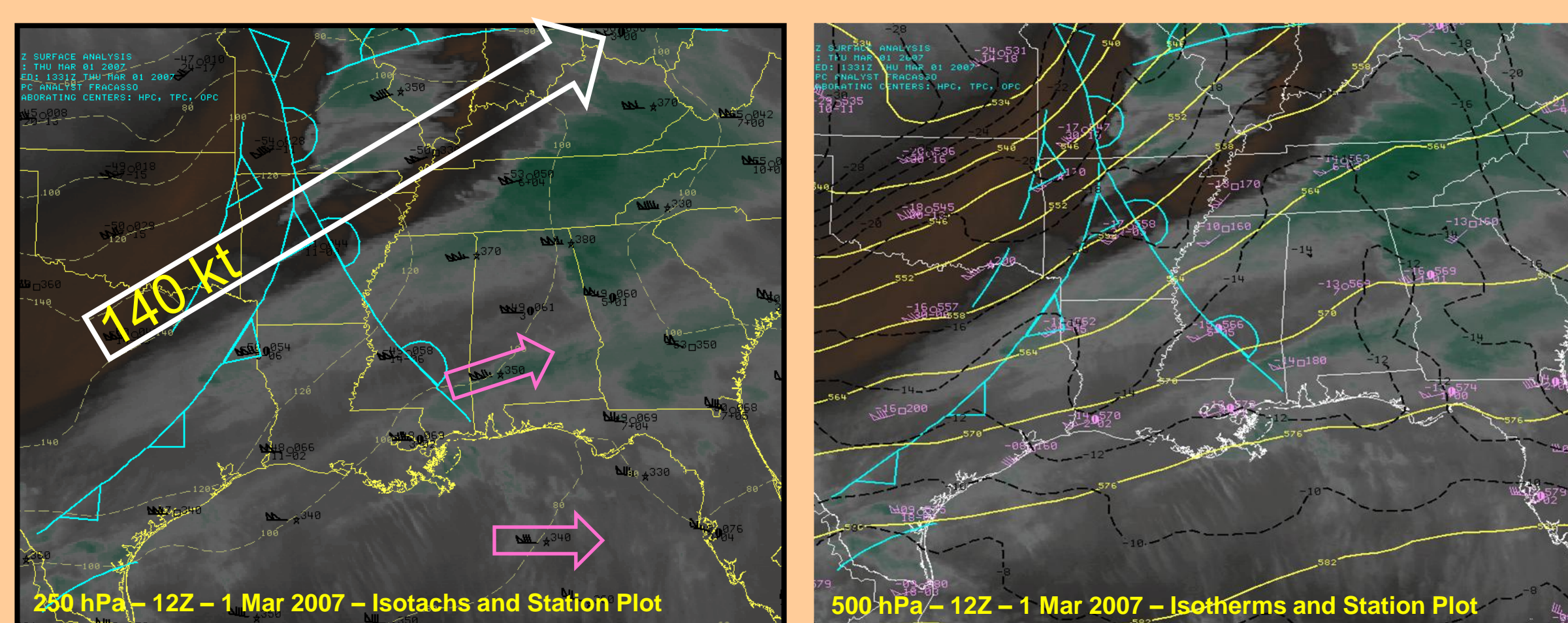
This research presents a multi-scale analysis of the event. Particular attention is paid to the kinematics of the flow field, the evolution (and distribution) of the vertical wind shear profile and to layer advective processes that altered the environmental lapse rate and moisture distribution prior to tornado production. Finally, radar data are used to present the overall evolution and morphology of the Millers Ferry mesocyclone and to focus on salient points regarding radar sampling issues and how they factor into the warning decision process.

### Synoptic and Mesoscale Evolution

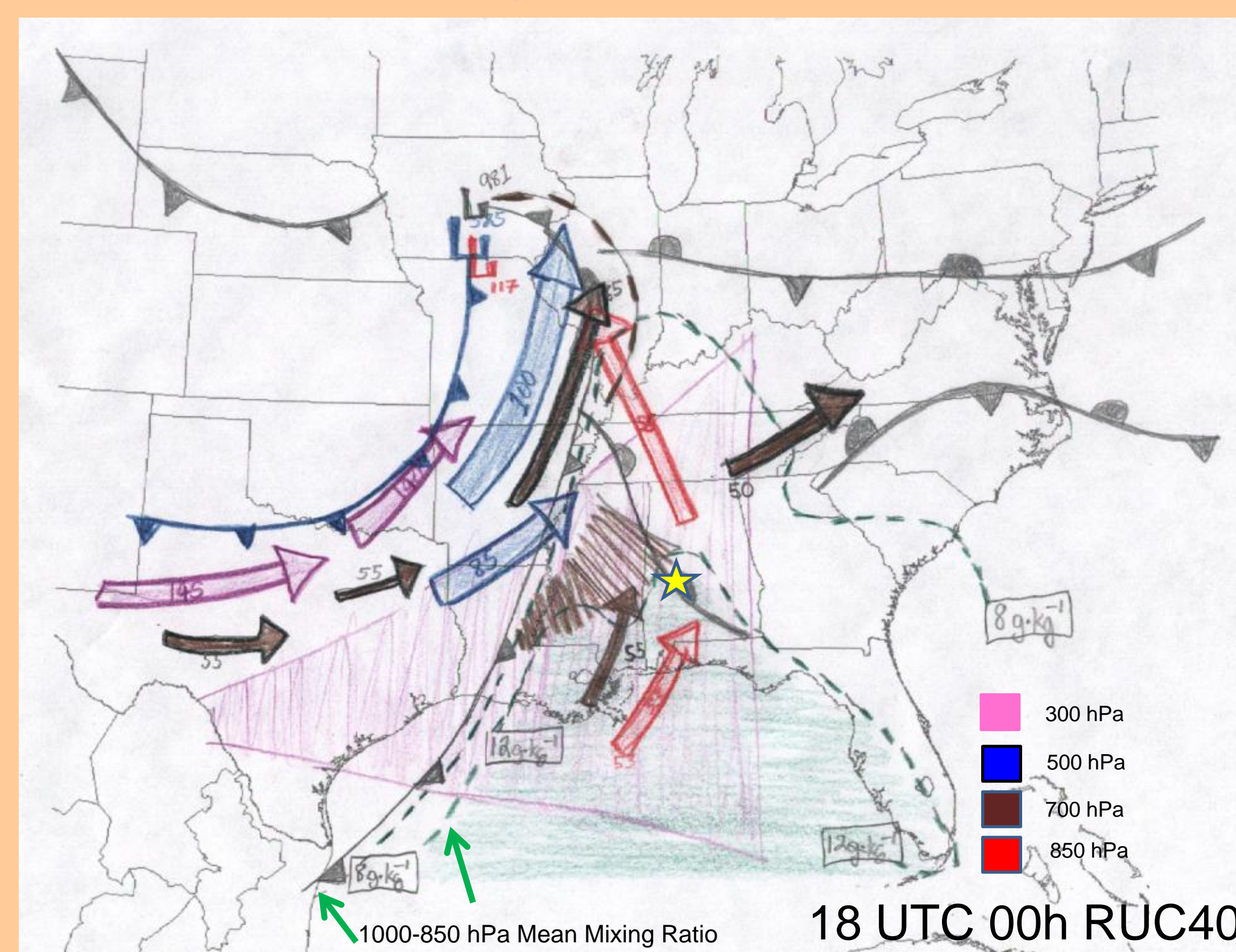
#### Modified Sounding and Hodograph



#### 12 UTC Upper Air

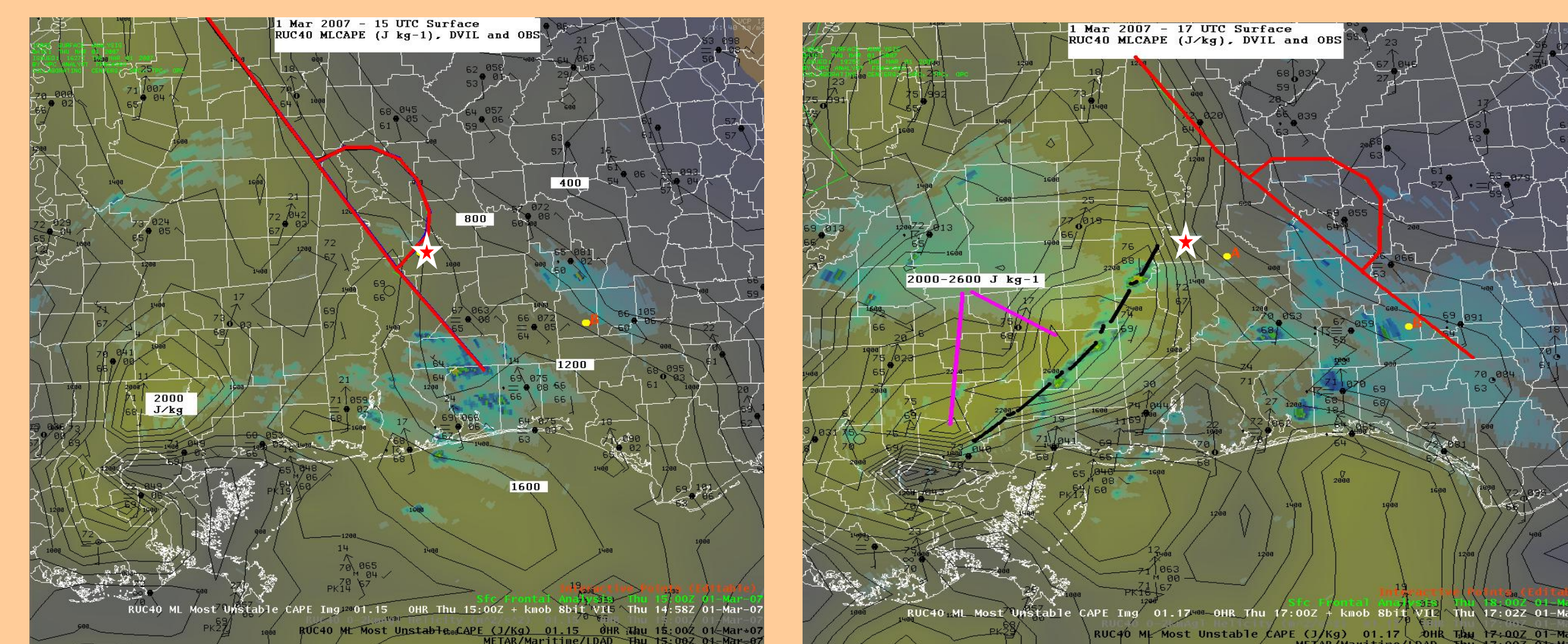


#### 18 UTC Synoptic Severe Composite

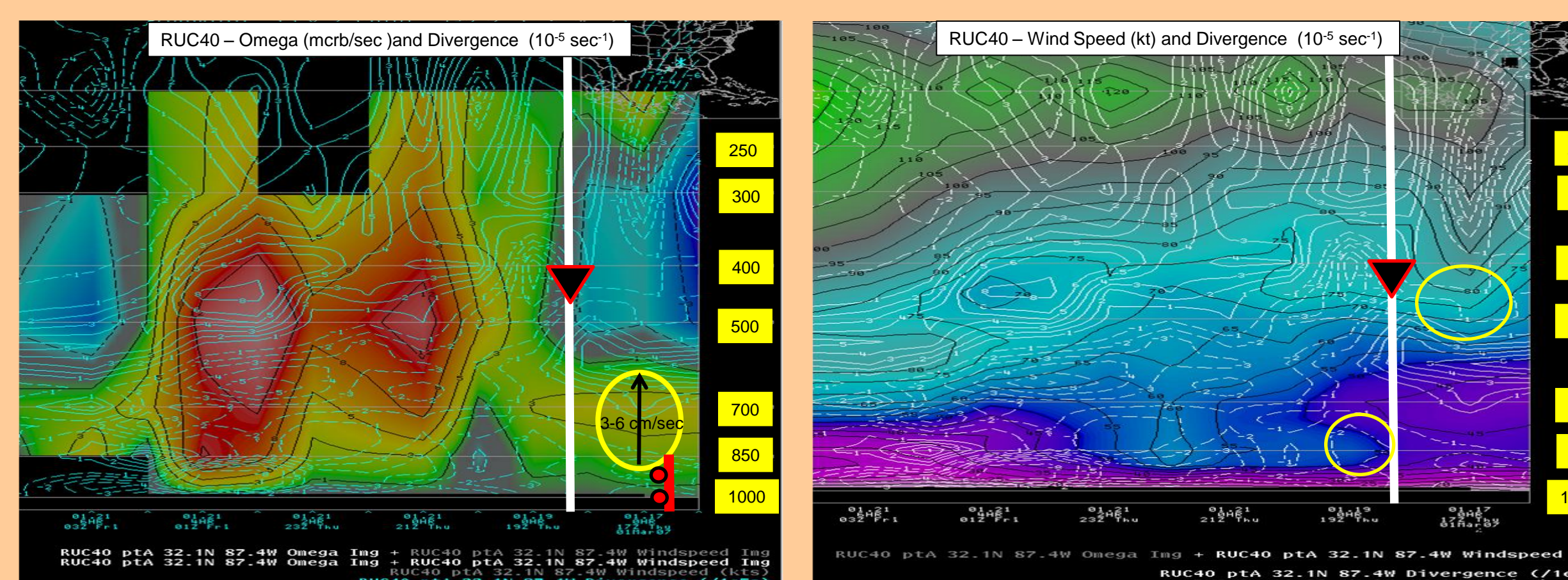


### Synoptic and Mesoscale Evolution

#### Surface Evolution

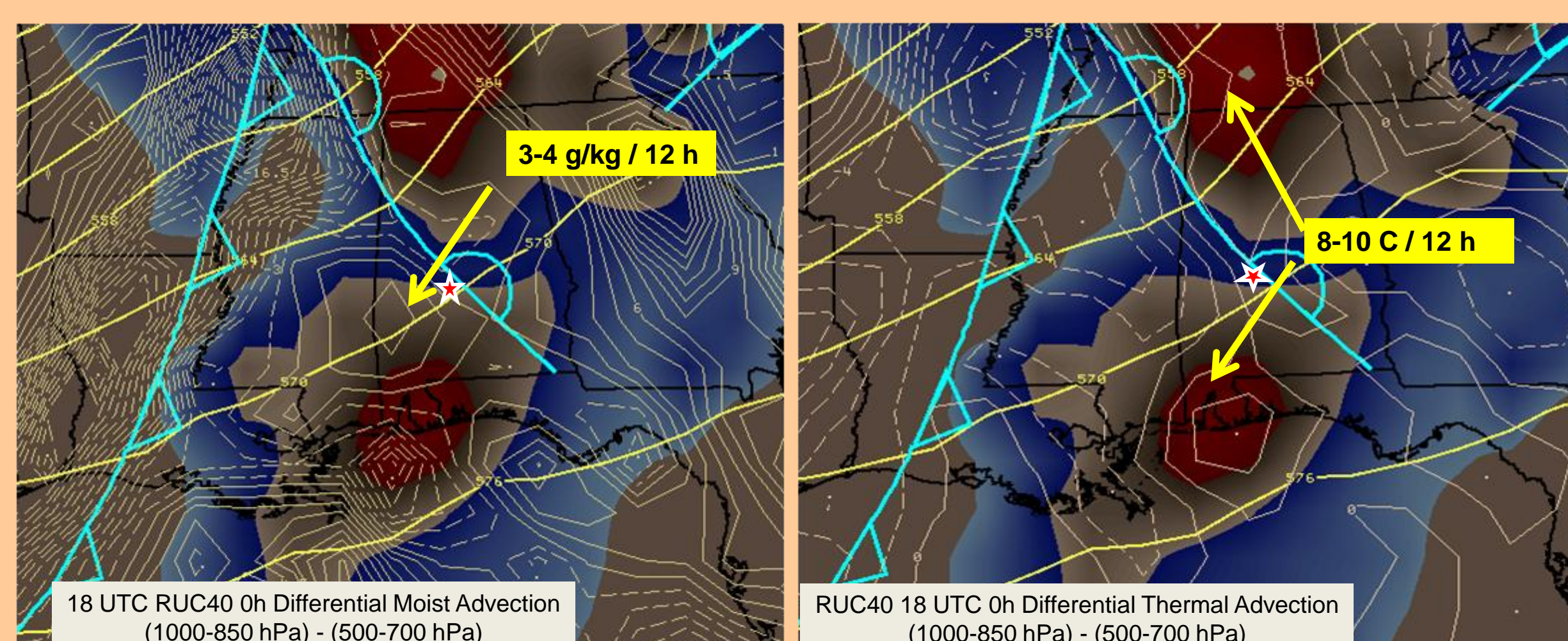


#### 18 UTC NCEP RUC40 Time-Height



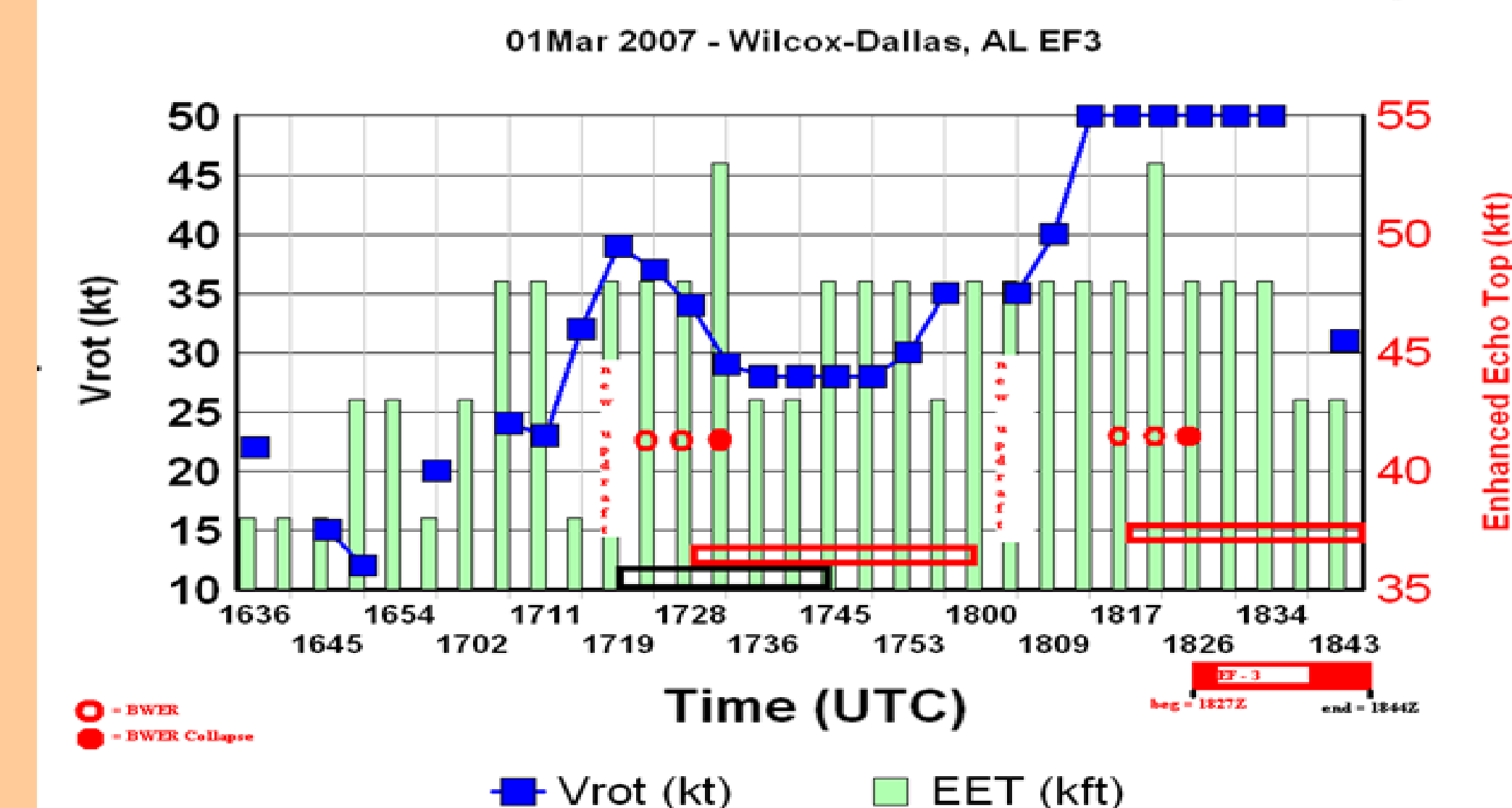
An EF-4 tornado-producing mesocyclone developed along a low level convergent boundary (see 17 UTC SFC above) and moved over the region in question about an hour after the surface warm frontal passage. Being located within a mid-tropospheric divergent zone and just downstream from the nose of a 27 m/s lower tropospheric jet streak (where 0-2 km  $S_r$  Helicity values were maximized) kinematics worked in concert to enhance mesoscale lift in vicinity of the relatively shallow-sloped low-level frontal circulation.

Clearly, this event occurred in the surface warm sector and **well downstream** of the main mid- and upper air trough (and assoc/dynamics) and the surface cold front. It is surmised that both differential thermal and moisture advections in the 700-500 and 1000-850 hPa layers acted to further destabilize the local lapse rate where the tornado developed (see below).



### Mesocyclone Evolution

#### V<sub>rot</sub> vs. Enhanced Echo Top



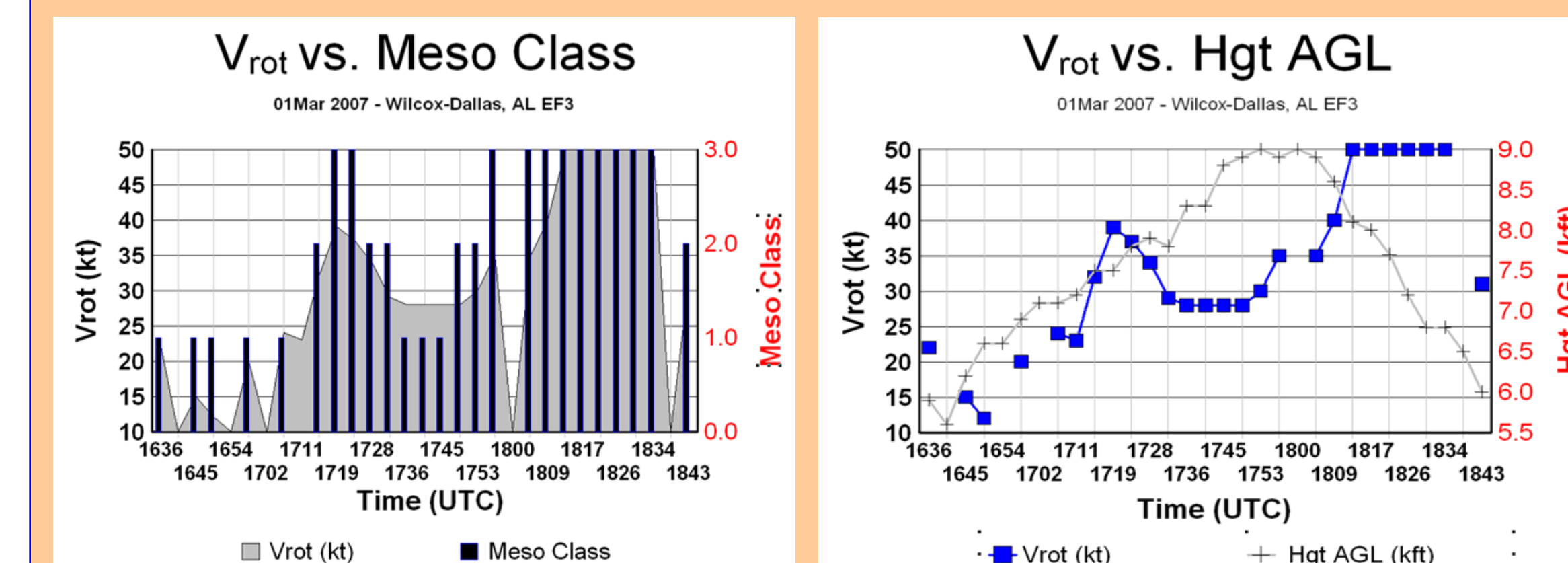
At 1636Z, the storm began as a cell merger over Wayne County in southeastern Mississippi. The southern most updraft became dominant. The figure above shows the evolution.

A long-lived mesocyclone with several significant pulses on the storm SE flank. The first pulse was strong and did not produce a tornado. The second pulse was strong and produced an EF-4 tornado. Each updraft pulse exhibited a BWER with a marked increase in rotation intensity

Mesocyclone was observed from 63-84 n mi range using both KMOB and KBMX WSR-88D.

$V_r$  Shear was not very helpful due to long range. For long range mesocyclones,  $V_{rot}$  is really preferred as a diagnostic tool because of velocity averaging in the sample volume. Of course, one also has to place heavy weight on **REFLECTIVITY** Characteristics. Timelines do not reflect the use of KBMX 8-bit velocity information. As it turned out, KBMX Level-II data showed (as viewed from *GR2 Analyst Version*) that the 1813, 1821, 1830, 1834 and 1828 UTC volume scans all exhibited velocity data dropout.

Upon computing the mesocyclone observed motion vector from 1817-1843 UTC, it was found that each 5 min volume scan was a constant 42 kt except for an observed 34 kt in the 1821-1826 interval (i.e., the time interval when an EF-4 tornado was forming).



### For Further Information

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